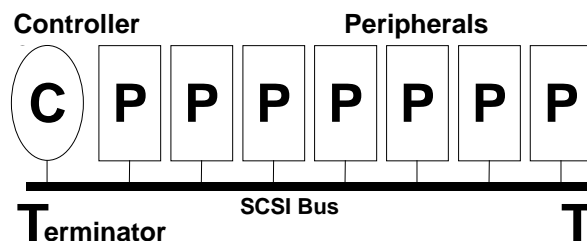


Small Computer System Interface (SCSI)

The Small Computer System Interface, better known as SCSI (pronounced scuzzy), allows multiple peripheral devices to be connected to a host computer. SCSI allows several disk drives, CD-ROM drives, scanners, printers and other external input/output devices to be accessed concurrently, simultaneously, or in sequence, as needed. SCSI is considered an intelligent interface because it is actually a computer chip that can handle the I/Os to and from a device by itself. When a host computer wants to write to a device it tells SCSI what to do and SCSI takes care of the write, allowing the host processor to do other work. When SCSI is finished, it lets the host processor know that the work is completed.

The Major Components of SCSI are:

- Host adapter card containing one controller and a terminator
- SCSI Bus (also called a SCSI Cable)
- SCSI compatible peripheral devices (disks, CD-ROM, tapes, etc.)
- A terminator representing the end of the SCSI bus

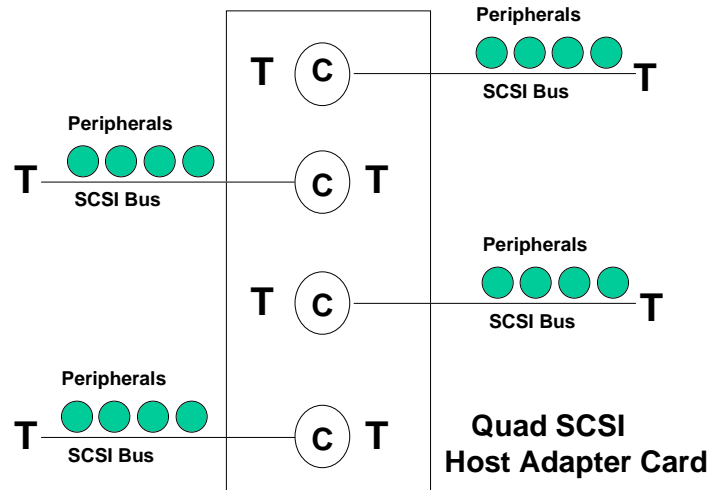


Multiple SCSI Controllers on One Host Adapter Card

Today, SCSI host adapters may contain up to four controllers on one card. Instead of buying four cards with one controller each, you get one card with four controllers. Each controller is considered a separate bus! (Note that not all controllers reside on a host adapter card. Some SCSI controllers are placed directly onto the motherboard.)

SCSI controllers today can control either 7 or 15 peripheral devices, depending on the SCSI controller and software implementation. A SCSI controller that can control 7 devices has an address range from 0-7. A SCSI controller that controls 15 devices has an address range from 0 to F. These address ranges allow one address for the controller and the remaining addresses for other peripherals. The end of this paper will list the various SCSI products, their transfer rates, and the number of devices supported.

In the picture below you see four SCSI controllers. Each SCSI controller has its own SCSI bus. Each bus can attach to 7 or 15 devices depending on the software. Each bus will have a terminator at the beginning of the bus and a terminator at the end of the bus.



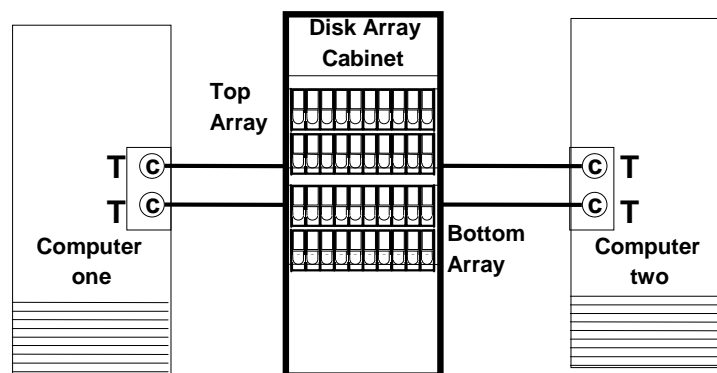
Shared SCSI (SSCSI)

The goal of *Shared SCSI* (SSCSI) is to allow two computers to share peripherals on the same bus. This is accomplished by placing a SCSI host adapter card in both computers. A terminator is placed on one of the host adapters to represent the beginning of the bus. A terminator is placed on the other host adapter to represent the end of the bus. The cable is run from the first to the second card connecting the shared peripherals in between. To control access to this bus, Shared SCSI (SSCSI) software is used on each host so that only one of the computers can access a device at any one time.

If you are using SCSI software that allows 8 addresses you can share six peripherals. Why only six? Because both host adapter controllers will need an address. Could you have Shared SCSI with more than just two computers? Absolutely yes! You can place many peripherals and many computers on the same bus. It comes down to the number of available addresses.

You may have heard the term "SCSI agent". Any controller or peripheral device on a SCSI bus may be referred to as an agent. A SCSI agent could be either a controller (intelligent chip) or a peripheral (disk, CD-ROM, tape, etc.) Newer buses may have up to 16 agents using the hexadecimal addresses 0 through F.

The picture below is an example of shared SCSI. It shows two computers sharing disk arrays with both computers containing a SCSI host adapter card. Each contains two controllers. The top controller on each card connects to the top disk array and the bottom controllers connect to the bottom disk array. The T on the left top controller signals the beginning of the SCSI bus. The T on the right top controller signals the end of the bus. Both computers now share the top and bottom disk arrays. SCSI host adapters utilizing shared SCSI do not need to be identical, just compatible

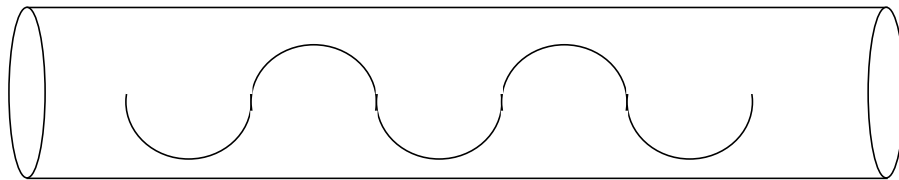


Single-Ended vs. Differential SCSI

You have probably heard the terms single-ended or differential SCSI. You might have heard someone say, “This disk is a single-ended disk.” The terms *single-ended* and *differential SCSI* refer to the techniques in which the electrical signals (that represent data) are transported on the SCSI bus.

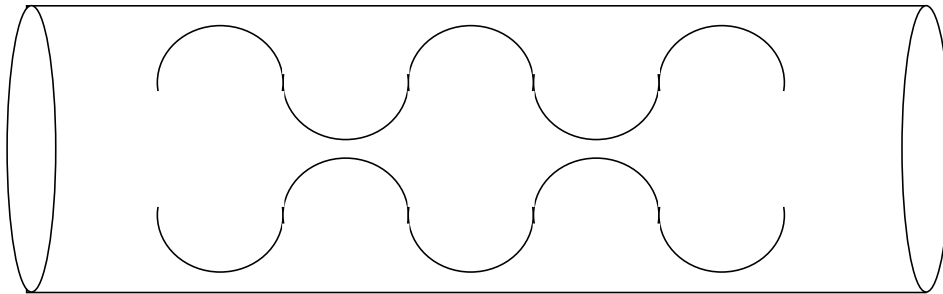
Basically, a single-ended SCSI agent sends one electrical signal and a differential SCSI sends two signals. A single-ended SCSI is used for short distances and a differential SCSI is used for longer distances. The differential SCSI is more expensive.

You can not connect a single-ended disk directly to a differential SCSI cable and vice versa. This can only be done with a translator in between.



Single-ended SCSI signal

Single ended SCSI is less expensive and used in shorter distances (up to six meters).



Differential SCSI signal

Differential SCSI goes longer distances (up to 25 meters).

SAF-TE

SAF-TE is an acronym for SCSI Accessed Fault-Tolerant Enclosures. The SAF-TE specification was co-developed by nStor Corporation and Intel in October 1995. It is an “open” specification designed to provide a comprehensive standardized method to monitor and report status information on the condition of disk drives, power supplies, and cooling systems used in high availability LAN servers and storage subsystems. The specification is independent of hardware I/O cabling, operating systems, server platforms, and RAID implementations because the enclosure itself is treated as simply another device on the SCSI bus.

SMART

SMART is an acronym for Self Monitoring Analysis and Reporting Technology. SMART pertains to disk drive manufacturers and is a standard for reporting an impending disk drive failure. With SMART, disk drives allow you to obtain early notification of impending disk drive failures. The BIOS will provide anywhere between 6 hours to one week notice before a drive fails.

IBM paved the way for SMART by marketing the industry’s first failure prediction capability for SCSI hard disk drives. There are two kinds of hard disk drive failures. They are unpredictable and predictable. Unpredictable failures happen quickly, without advance warning. These failures can be caused by static electricity, handling damage, or thermal-related solder problems and cannot be predicted. SMART works with predictable failures. A predictable failure is a gradual degradation of the drives performance. In fact, 60% of drive failures are mechanical and that is the kind of failure SMART is designed to predict.

SCSI Specifications

When it comes to discussing the various types of SCSI we need to understand the transfer speeds and how many agents can be connected to the bus. The chart below lists the various SCSI specifications.

- **SCSI-1** was the original SCSI. It utilizes an 8-bit bus and can support a transfer rate of close to 2.5 MB/second. It can support up to 8 agents.
- **Synchronous SCSI-2** was a firmware upgrade that increased the data transfer rate to 5 MB/second.

S m a l l C o m p u t e r S y s t e m I n t e r f a c e (S C S I)

- **Fast SCSI-2** provides a data transfer rate of up to 10 MB/second. It also utilizes an 8-bit bus. Fast SCSI also uses 50-pin SCSI connectors.
- **Fast and Wide SCSI-2 or Quad SCSI** (also called fast and wide SCSI) utilizes a 16-bit bus and can support data transfer rates of up to 20 MB/second. Wide SCSI can also support up to 16 agents on a SCSI bus.
- **Ultra SCSI** (also known as SCSI 3) utilizes an 8-bit bus and can support data transfer rates of up to 20 MB/second. It supports up to 8 agents.
- **Ultra2 SCSI** is an 8-bit bus and can support data transfer rates of up to 40 MB/second. It can support up to 8 agents.
- **Wide Ultra SCSI** utilizes a 16-bit bus and can support data transfer rates of up to 40 MB/second. It supports up to 16 agents.
- **Wide Ultra2 SCSI** is a 16-bit bus and can support data transfer rates of up to 80 MB/second. It can support up to 16 agents.

(To confuse you even more the SCSI Trade Association has developed a new naming convention. In the past variations of SCSI were referred to as SCSI, SCSI-2, and SCSI-3. Classic SCSI is now simply known as SCSI-1. SCSI-2 is now referred to as Fast SCSI and SCSI-3 is now known as Ultra SCSI.)

Key Points to Remember

- SCSI (Small Computer System Interface) is an industry and ANSI standard, which provides the computer with an intelligent interface to peripherals.
- Major SCSI components include the host adapter card, SCSI bus, peripheral device and terminator.
- Each SCSI bus can support either 8 or 16 agents and will have transfer rates ranging from 5 to 80 MB/second.
- Shared SCSI allows two computers to share peripherals on the same bus.